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THE REGULATION OF URANIUM REFINERIES AND CONVERSION FACILITIES IN CANADA

by

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Paper

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ABSTRACT

The nuclear regulatory process as it applies to uranium refineries and conversion facilities in Canada is reviewed.

In the early 1980s, Eldorado Resources Limited proposed to construct and operate new facilities for refining yellowcake and for the production of uranium hexafluoride (UF_6). These projects were subject to regulation by the Atomic Energy Control Board (AECB). A description of the AECB's comprehensive licensing process covering all stages of siting, construction, operation and eventual decommissioning of nuclear facilities is traced as it was applied to the Eldorado projects. The AECB's concern with occupational health and safety, with public health and safety and with the protection of the environment in so far as it affects public health and safety is emphasized.

Some regulatory difficulties encountered during the project's development which led to opening up the licensing process to public input and closer coordination of regulatory activities with other provincial and federal regulatory agencies are described.

The Board's regulatory operational compliance program for uranium refineries and conversion facilities is summarized.

RÉSUMÉ

Le présent rapport examine le programme de réglementation nucléaire des raffineries et des usines de conversion d'uranium.

Au début des années quatre-vingt, la société Les Ressources Eldorado Limitée a proposé de construire et d'exploiter de nouvelles installations pour raffiner le concentré d'uranium et produire de l'hexafluorure d'uranium (UF_6). Ces projets sont assujettis à la réglementation de la Commission de contrôle de l'énergie atomique (CCEA). Le rapport décrit toutes les étapes du régime de permis détaillé de la CCEA qui couvrent le choix du site, la construction, l'exploitation et le déclassement éventuel des installations nucléaires et en traite dans le cas particulier des Ressources Eldorado Limitée. Le rapport traite en particulier de l'intérêt que la CCEA porte à la santé et à la sécurité au travail, à la santé et à la sécurité du public, ainsi qu'à la protection de l'environnement.

D'autre part, le rapport aborde certaines difficultés de réglementation durant la mise au point du projet qui ont entraîné la participation du public au processus de réglementation et une coordination plus étroite des activités de réglementation avec les autres organismes de réglementation fédéraux et provinciaux.

Le rapport résume enfin le programme de surveillance réglementaire de la CCEA quant aux activités des raffineries et des usines de conversion d'uranium.

1. INTRODUCTION

In passing the Atomic Energy Control Act[1] in 1946, the Parliament of Canada declared atomic energy to be of national interest and therefore under the exclusive jurisdiction of the federal government. The Atomic Energy Control Board (AECB) was created to administer the Act which provides for the control and supervision of the development, application and use of atomic energy. Under the provisions of the Act, the Board issued the Atomic Energy Control Regulations[2] which determine the authorization and supervision regime applicable to all nuclear facilities. The Board has chosen to issue only general, skeletal regulations; specific regulatory requirements are applied through the licensing process.

2. STRUCTURE OF THE AECB

The AECB is an organization consisting of a Board of five members and a supporting technical and administrative staff of approximately 265 persons. In the following text, the "Board" means the five-member Board and the "AECB" means the organization and its staff. (See Figure 1).

Various Divisions of the AECB's Directorate of Fuel Cycle and Materials Regulation are responsible for regulating mines and uranium mills, refineries and conversion plants, fuel fabrication plants, heavy water plants, radioactive waste management facilities, transportation and packaging, and the use of radioisotopes. The Fuel and Heavy Water Plant Division (FWD) has responsibility for uranium refinery and conversion plant licensing and compliance activities. Most licensing assessment and review work and facility inspections are carried out by project officers of the FWD who are mainly "generalists". They are complemented by staff specialists in radiation protection, quality assurance and a variety of engineering disciplines.

Not involved in licensing but reporting separately to the Board are two advisory groups, the Advisory Committee on Radiological Protection and the Advisory Committee on Nuclear Safety.

3. SAFETY PRINCIPLES AND OBJECTIVES

Over the course of the AECB's existence safety principles and objectives have been developed that underlie its regulations and licensing practices. The Board's Advisory Committee on Nuclear Safety has produced a document[3], which was endorsed by the Board, on the safety objectives for nuclear activities.

The underlying concept is that the primary responsibility for achieving a high standard of safety resides with the licensee. The regulatory agency in turn is responsible for providing the objectives for nuclear safety and the guidelines for their application as well as for auditing industry's performance. This approach leads to the regulatory body having to determine how effectively the safety objectives are being achieved.

4. LICENSING PROCESS

The licensing process is the means by which the AECB gains assurance that a nuclear facility will be sited, designed, constructed, commissioned and operated in compliance with safety criteria and requirements established by the AECB.

This assurance is achieved by establishing communication with the applicant at an early stage in the project and maintaining surveillance over all safety-related activities in each phase of the project's development from the initial conceptual design of the facility through to its mature operation. The intent is to identify points of contention at as early a stage as possible to avoid situations where the applicant will find it economically difficult to make changes required by AECB staff.

4.1 Licensing Stages

For all nuclear facilities, the Board has established distinct administrative steps for the implementation of its authority. (See Figure 2). These consist of site acceptance which includes a public information program, approval to construct and a licence to operate. The applicant must convince the Board in detailed written submissions that the plant will meet the health, safety and security requirements of the Regulations. Details for these submissions are normally available in the form of guidelines.[4]

Although the nuclear industry is subject to federal jurisdiction through the Atomic Energy Control Act, it has to be realized that a nuclear facility operating within a geographical location in a certain province of Canada, has some impact on that province and therefore provincial regulatory agencies do have a legitimate concern with regard to the operation of the facility.

In recognition of this joint interest, the Board has established a <u>joint regulatory process</u>. This means that the Board, as a lead agency, invites all regulatory agencies, federal and provincial, whose area of responsibility could

be impacted on by the proposed nuclear facility to participate in a consultative regulatory process. This process ensures that legitimate concerns of any agency, federal or provincial, are considered in the regulatory process and are reflected in the licence in the form of a condition or requirement. Figure 3 outlines a Joint Regulatory Process chart as it might apply to a Site Assessment situation.

In many cases, the applicant may be required by an environmental agency to prepare an environmental impact statement and submit it to a formal hearing or review process. The impact statement normally includes the type of information required by the AECB for site acceptance and can be submitted for that purpose. If a hearing is required by another agency the AECB withholds any site acceptance until the results of the hearing are available and evaluated.

4.1.1 Site Acceptance

The basic objectives at the Site Acceptance stage are to establish the conceptual design of the facility and to determine whether it is possible to design, construct, and operate the facility on the proposed site to meet the safety objectives and requirements established by the AECB. The primary documentation required is a Site Evaluation Report providing a summary description of the proposed facility and its impact on the environment including information on land use, present and predicted population, principal sources and movement of water, water usage, meteorological conditions, seismology and local geology.

During this phase of the licensing process, the applicant is required to announce publicly his intentions to construct the facility and to hold public information meetings at which the public can express its views and question the applicant's representatives.

4.1.2 Construction Approval

Prior to granting a Construction Approval the AECB must be assured that the design is such that the AECB safety principles and requirements will be met and that the plant will be built to appropriate standards. In order to do this, it is necessary that the design be sufficiently advanced to enable safety analyses to be performed and their results assessed.

Construction will only be authorized once the design and safety analysis programs have progressed to the point that, in the judgment of the AECB, no further 'significant' design changes will be required.

4.1.3 Operating Licence

Before issuing an Operating Licence the AECB must be assured, primarily, that the plant, as built, conforms to the design submitted and approved, and that the plans for operation are satisfactory. The requirements include submission of a Final Safety Report, completion of a previously approved commissioning program, and approval of operating policies and principles.

5. AECB LICENSING OF ELDORADO RESOURCES LIMITED FACILITIES FOR UO_3 AND UF_6 PRODUCTION

5.1 Background

Eldorado Resources Limited, a federal Crown corporation, has been mining and refining first radium and then uranium for 50 years. At present the Blind River refinery, in Blind River, Ontario, processes yellowcake concentrates from uranium mines in Canada and other countries to produce UO_3. In Port Hope, Ontario, the UO_3 is further processed to uranium dioxide (UO_2) fuel for CANDU reactors and also to uranium hexafluoride (UF_6) for export.

In light of a growing world-wide demand for UF_6 in the mid 1970s, Eldorado proposed to build a second uranium refinery in Ontario with a capacity of 9,000 tonnes per year of uranium as UF_6. Eldorado began the process of selecting a site for a new Ontario uranium refinery in 1975. By 1976, a long list of potential sites had been narrowed to four.

5.2 Environmental Review Processes

Of the four Ontario sites studied, the site at Port Granby (20 km from Port Hope) was chosen by Eldorado for development of a refinery. Over the following year a detailed Environmental Impact Statement (EIS)[5] was prepared and submitted to a panel set up by the federal government's Environmental Assessment and Review Process (EARP). Following technical and public review of the EIS, the Port Granby refinery proposal was the subject of two rounds of public hearings. The Atomic Energy Control Board participated in the hearings, providing technical analysis on Eldorado's proposal and explaining the Board's regulatory process to the panel. In early 1978 the panel concluded that the refinery itself and the refinery processes could be environmentally acceptable

on an appropriate site if a number of conditions were met. The Port Granby site, however, was found to be unacceptable for a variety of reasons related to air quality, waste management, land use and social impacts.

Following the rejection of the Port Granby proposal, Eldorado identified potential sites in each of the Port Hope (Hope Township), Sudbury and Blind River areas of Ontario. The Hope Township site ranked highest in Eldorado's consideration. Following environmental hearings on all the sites, the Panel's report[6] was issued in February, 1979, concluding that all three sites could be acceptable for the project. In July, 1979, it was announced that the Federal Cabinet had concurred with Eldorado's selection of Hope Township as the preferred site for the Ontario refinery. Site preparation work began in early 1980 but was suspended when the Federal Cabinet (of a newly elected government) reviewed the earlier decision and determined that the refinery should be located at Blind River. Eldorado then proposed that the UO_3 production facility be sited at Blind River but that the UF_6 conversion facility be sited on the old Port Hope Plant property.

Eldorado publicly announced its proposals and the site applications for AECB approval of the Blind River refinery[7] and the Port Hope UF_6 conversion facility[8] were filed on September and October, 1980, respectively. With respect to the subject of environmental assessment, Eldorado chose not to submit the new proposal to the EARP process. The Board staff indicated that a specific environmental assessment process (non public hearing process) would be necessary and that this would be part of the Board's joint regulatory process.

The Blind River site although changed slightly from the original site proposed, did not present a problem to the AECB, the general area having been extensively reviewed by regulatory agencies and accepted by the EARP Panel. The Port Hope site, however, had not been subjected to any environmental assessment process and further, it did not provide for a "buffer zone", an area surrounding a nuclear facility which is under the control of a licensee.

Figure 4 shows the difference in the two approaches (public environmental hearing vs AECB public meeting format with joint regulatory review).

5.3 Licensing of the Blind River Refinery

In September 1980, Eldorado applied formally to the AECB for approval to site the Blind River refinery on a 263 hectare site in the town of Blind River, Ontario. Board staff considered Eldorado's change from the original proposal.

5.3.1 Site Assessment

The regulatory reviews of the Eldorado Site Application[7] and other documents[7] presented to the AECB and the Interagency Review Committee, identified a number of deficiencies in the reports and requests for further clarification were submitted to Eldorado. Eldorado's responses to these requests were evaluated and considered acceptable by the AECB staff and IRC. The AECB staff recommended to the Members of the Board, in January, 1981, that site approval should be given.

5.3.1.1 Public Intervention

Following the government's decision that Eldorado establish a uranium refinery at Blind River, Ontario, some members of the public from the town of Blind River and surrounding area, claimed that the changes in Eldorado's planning warranted new public hearings. Conversely the Board staff believed that the change in site location was not sufficiently significant to require that a new public hearing be carried out.

In November, 1980, the Board received a submission from the Blind River and District Concerned Citizens Association reviewing Eldorado's site application. Although a number of their concerns had merit and were considered by Board staff in its evaluation, no new technical concerns were identified which would alter the Board staff position. At its January, 1981 meeting, the Board agreed to receive representatives from two groups. These groups were strongly opposed to nuclear energy in general and to the establishment of the Blind River refinery in particular.

After hearing the groups' presentations, the Board decided to defer a decision on site approval to allow staff an opportunity to study last minute submissions and to discuss the concerns in person with all groups in the Blind River area. The AECB attended a series of meetings with various public groups including local government elected officials. The AECB made presentations on the Board's mandate, the refinery licensing

review procedures and the issues of air and water quality, radioactive wastes and radiation effects, as well as responding to questions and listening to public concerns. Following these meetings, the AECB staff concluded that no new information bearing on matters of health, safety, security or the environment had been presented which would alter its original recommendation that the site be approved for the purposes intended.

In mid-February, 1981, the AECB announced that it had approved Eldorado's application to site a uranium trioxide refinery near Blind River, Ontario.

Some details on the public participation and input during the course of the Blind River refinery site evaluation process is presented here to provide an indication of the extent to which the AECB's licensing process has become a more open one. In 1970, when an UF_6 Plant in Port Hope was licensed to operate almost no public information was made available on the AECB approvals and no public participation in the licensing process was contemplated.

5.3.2 Construction Authorization and Operating Licence

In February, 1981, Eldorado applied for Construction Authorization[9] to build the refinery. Information was presented to the AECB on facility design and layout, process description, safety programs, accident analysis, emergency procedures and quality control programs for design, procurement and construction. Eldorado's application and supporting information was reviewed by the AECB staff and by member agencies of the Interagency Review Committee. (See Figure 5).

It was noted that the refinery was designed to recycle as many wastes streams as possible and to minimize the number of discharge points. This design approach combined with monitoring and control programs proposed by Eldorado would enable detection and corrective action to be taken to limit the effects of upset situations to the environment.

A detailed accident analysis indicated that no credible scenarios were identified which did not have acceptable design features included to mitigate their consequences.

Construction Authorization for the construction of the uranium trioxide refinery in Blind River, Ontario, was granted by the Board in July, 1981.

In August, 1983, construction and commissioning of the refinery having been completed, the AECB granted Eldorado an operating licence. Leading up to this approval, the AECB staff had reviewed all the necessary commissioning reports on all major safety and environmental control systems and found the systems were in satisfactory condition for start-up. As well, radiation protection procedures for the plant were reviewed and some changes made as requested by the AECB staff. A Derived Release Limit (DRL) document was prepared by Eldorado and reviewed by the AECB staff. The plant design allows the plant to operate at less than 1% of the DRLs.

5.4 Licensing of the Port Hope UF_6 Facilities

In October, 1980, Eldorado applied formally to the AECB for approval to expand the uranium hexafluoride conversion facilities to include a new plant with an annual capacity of 9,000 metric tons of uranium, in the town of Port Hope adjacent to its existing Port Hope facility. An Interagency Review Committee, consisting of the AECB, Health and Welfare Canada, Environment Canada and the Ontario Ministry of the Environment, was formed to review Eldorado's application.

5.4.1 Site Assessment

A document "Application to the Atomic Energy Control Board for Site Approval - Port Hope UF_6 Facilities Expansion, October 1980"[8], was submitted to the AECB and IRC in support of the site approval application. The document was based on the AECB requirements and guidelines specified in the Atomic Energy Control Board licensing documents.[4]

Some of the significant issues identified are presented below.

1. The regulatory agencies agreed that if the proposed site was accepted, future approvals for the operation of the new UF_6 Plant would be contingent upon the existence of a clearly defined waste management plan.

Eldorado proposed to design the new facilities to reduce the quantity of wastes to a minimum. For example, a new process incorporated into the design of the new UF_6 facility allows recycle and recovery of

hydrofluoric acid and an eight-fold reduction in CaF_2 generated. Eldorado had also made significant progress in the recovery and recycling of waste materials.

2. The lack of a large "buffer zone" was of concern to the IRC and therefore, the conceptual design of the facility was reviewed to ensure that appropriate design measures were proposed to compensate for the small buffer zone available and to ensure that the public would not be exposed to unacceptable levels of radiation and hazardous substances during normal and upset processing conditions.

Eldorado proposed to incorporate a number of technical features into the plant design which would give an increased measure of confidence in its ability to contain releases as follows:

- all effluent gas scrubbers and dust collectors will be installed inside the structure of the operating plant,
- secondary scrubbers will be installed to handle upset or emergency situations,
- all HF unloading from railcars will be carried out in an enclosed and ventilated building. No transfer of HF to the processing areas will take place without secondary containment,
- all liquid UF_6 handling (filling of shipping containers and sampling operations) will take place in autoclaves and inside the processing buildings,
- emergency electric power maintains the operation of key emission control systems.

Eldorado had designed additional environmental and engineering features into the proposed UF_6 facility to provide an adequate margin of in-plant safety systems, without reliance on the "buffer zone".

5.4.1.1 Public Information

Eldorado satisfactorily met the AECB's requirements for conducting a public information program. This program culminated with the holding of two public meetings in Port Hope in November and December, 1980. In general, the Port Hope public responded favourably to the idea of the Eldorado facilities being expanded in their town.

In July, 1981 the AECB approved the Port Hope site based on a recommendation from the AECB staff. The Board required Eldorado to carry out some further studies on the atmospheric dispersion modelling information presented in its application for site approval, as well as studies of groundwater flow on the site, as conditions of the approval.

5.4.2 Construction Authorization

In December, 1981, Eldorado submitted an application[10] to the AECB requesting approval to construct the proposed facility. The AECB staff and the IRC assessed the information presented by Eldorado to assure the reviewers that the design of the proposed facility would meet the safety and environmental requirements of the AECB and other regulatory agencies.

In April, 1982 Eldorado was granted partial approval to proceed with the plant construction. Eldorado was directed not to proceed with work on the HF unloading and storage area until further review on these facilities was carried out.

As well as the review of Eldorado's construction application[10] by the AECB and IRC, the AECB and Environment Canada contracted with engineering consultants to review Eldorado's proposed methods of bulk handling and storage of HF and NH_3 and to review the submitted accident analysis for possible omissions of significant events.

In May, 1982, after consideration of all of the information made available to it, the Board staff recommended that Construction Authorization be granted for all those remaining plant components which were not covered in the partial construction approval granted in April, 1982. The AECB agreed to grant this approval.

5.4.3 Technical Considerations of the Regulatory Review

5.4.3.1 Siting Considerations

A number of issues were identified in the review of Eldorado's Siting Application which required satisfactory completion or further studies to be carried out in order to obtain additional design information to allow for a complete evaluation of Eldorado's proposal to construct the facility. The following summarizes some of the more significant issues:

(a) The review of the atmospheric dispersion modelling used in the Site Application[8] led to the conclusion that the modelling may not be appropriate to the Port Hope site. Eldorado was requested to carry out validation tests and a sensitivity analysis to show that the atmospheric dispersion modelling information presented in the Site Application was valid for the Port Hope area.

Eldorado performed the requested work and Board staff concluded that the information contained in the study was adequate to satisfy the requirement of model validation and sensitivity analysis of the atmospheric dispersion modelling used.

(b) The Site Application[8] did not contain sufficient information to substantiate the claims that the groundwater flow from the proposed plant site was not in a southwest direction towards the Town of Port Hope's Water Treatment facility which contains a number of underground water storage chambers.

Eldorado was requested to conduct a further study to determine the groundwater flow direction.

The results of the study were used to determine whether additional containment facilities were required on the plant site and the type of contingency plans and monitoring programs to be developed for plant operation.

5.4.3.2 Construction Review

The Eldorado Construction Application was reviewed with particular emphasis placed on the design criteria, engineering design and proposed operation of those pieces of equipment and systems which have the greatest potential to cause significant releases of radioactive and toxic non-radioactive substances to the workplace and public environment. The plant safety systems were assessed to ensure that adequate design criteria were used in their design to mitigate the effects of normal and abnormal plant operations. Also, the Quality Assurance programs for the design, procurement and construction phases of the project were assessed to ensure that the necessary controls were being implemented.

The following is a brief summary of the major items reviewed:

a) The gaseous effluent treatment system for the new UF_6 facility consists of a series of large potassium hydroxide scrubbers and a number of dust collection systems. The scrubbing systems, designed for high efficiency fluoride removal, are arranged such that they can be operated in several series and parallel configurations to allow for plant upsets and to permit on-line preventative maintenance programs to be conducted.

In order to provide additional containment in the event of an accident, the HF storage building, F_2 cell maintenance area and the UF_6 product handling areas have separate, independent ventilation systems.

Eldorado had proposed an abatement system which should be able to adequately control air emissions.

b) The UF_6 Product handling operations of the facility are located in areas physically segregated from the other plant processes. The UF_6 transport cylinders are filled in an area with its own emergency ventilation system and all sampling of hot UF_6 cylinders is done in autoclaves.

c) The design of the HF unloading and storage facility was a major review item for Board staff. Eldorado had proposed to build an HF facility which incorporates a structure to totally enclose two storage tanks, a below grade emergency storage tank and the rail car unloading station. This structure is ventilated and any HF emissions are scrubbed before release to the environment.

5.4.4 Operating Licence

By May, 1984 Eldorado had successfully commissioned all the utilities, major process areas of the plant, and safety systems and requested authorization to proceed with start-up of the plant to produce UF_6. A positive

recommendation was made to the Board and the operating licence was approved. An operating licence containing nineteen conditions of operation was issued to Eldorado, on May 28, 1984, to operate the new UF_6 Plant in Port Hope.

5.4.4.1 Technical Considerations

(a) Board staff conducted a design audit of the process safety systems and considered them acceptable.

(b) During the construction phase, audits of quality assurance on the liquid HF, F_2 gas distribution and liquid UF_6 storage and handling system were carried out by the AECB staff and Ministry of Consumer and Commercial Relations (MCCR) staffs. All of these systems were jointly approved and accepted by the MCCR and AECB staff.

(c) AECB staff reviewed commissioning data and documentation related to all safety systems. A detailed review of environmental monitoring procedures was conducted and accepted by the Ontario Ministry of the Environment and Environment Canada staffs.

(d) Eldorado prepared detailed operational quality assurance manuals and procedures to control and maintain minimum standards on all safety-related aspects of plant operations. In addition, a program had been set-up for in-service inspection to minimize the probability of failure of piping and equipment.

(e) Detailed emergency procedures have been prepared by Eldorado and reviewed by Board staff and found to be acceptable.

(f) A derived release limit document was prepared and included data on the plant emissions and discharges. This was reviewed by Board staff and is considered acceptable. Eldorado was obliged, as a condition of licence, to maintain the airborne uranium emissions from the total Port Hope facility to less than 10% of the sum of the weighted DRL's, based on weekly averages. A gamma component was later added to the DRL control equation.

(g) Board staff reviewed the operator training program for the plant and considered it acceptable, including the training and operating procedure for the anhydrous HF acid storage area.

It was on the basis of this comprehensive review and assessment that the AECB staff recommended that ERL be permitted to commence operation of the plant to produce UF_6.

6. AECB Licensing Compliance and Surveillance

Compliance and surveillance of the licensee operations is carried out to determine whether the requirements of the Atomic Energy Control regulations and the conditions specified in the facility licence are being met. Issues and items relating to compliance are reviewed and assessed by the assigned project officer with assistance from specialists in other divisions within the AECB and outside agencies. Staff from provincial agencies may be, in some cases, appointed AECB inspectors for purposes of inspecting the licensees' facilities and for auditing the licensees' monitoring results. These inspections are done on behalf of these agencies themselves although reference may be made to the AECB licence. The AECB staff exercises a senior auditing function in cases where other agencies are involved.

Compliance reviews, assessments and recommendations by AECB staff and outside agencies are submitted to the AECB for consideration in taking regulatory action and as factors during licence renewal periods.

References

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4. AECB Licensing Document No. 35, Fuel Facility Licensing, Part I - Regulatory Policy and Licensing Procedures, February, 1985.
   - AECB Licensing Document No. 35A, Guide To The Licensing of Uranium Refineries and Chemical Conversion Facilities, September, 1978.
5. Environmental Impact Assessment, The Port Granby Project, Eldorado Nuclear Limited, September 1977.
6. Report of the Environmental Assessment Panel, Eldorado Uranium Hexafluoride Refinery, Ontario, Federal Environmental Assessment Review Office, Government of Canada, February 1979.
7. Environmental Impact Statement for a Uranium Hexafluoride Refinery, Blind River, Eldorado Nuclear Limited, September 1978, prepared by James F. MacLaren Limited.
   - Application to the Atomic Energy Control Board for Site Approval, Blind River Refinery, Eldorado Nuclear Limited, September 1980.
8. Application to the Atomic Energy Control Board for Site Approval, Port Hope UF_6 Facilities Expansion, Eldorado Nuclear Limited, October 1980.
9. Application to the Atomic Energy Control Board for Construction Approval, Blind River Refinery, Eldorado Nuclear Limited, February 1981.
10. Application to the Atomic Energy Control Board for Construction Approval, Port Hope UF_6 Facilities Expansion, Eldorado Nuclear Limited, November 1981.

ORGANIZATION CHART
ATOMIC ENERGY CONTROL BOARD
1 JANUARY 1984

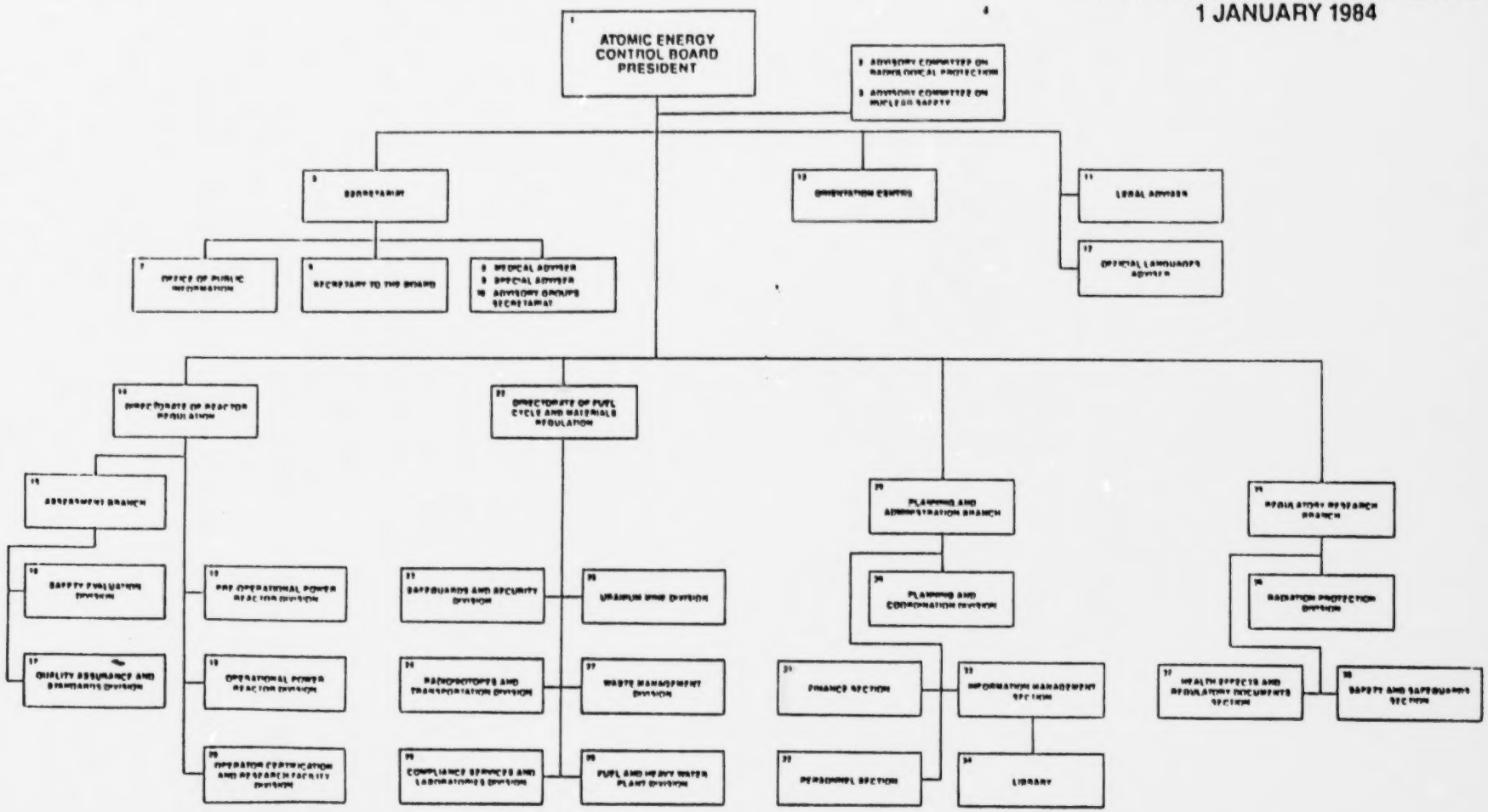


FIGURE 1

STEPS IN THE LICENSING OF A NUCLEAR FACILITY

1) PUBLIC INFORMATION PROGRAM

2) SITE ACCEPTANCE

3) CONSTRUCTION APPROVAL

4) LICENCE TO OPERATE (LIMITED PERIOD)

5) SITE CLOSURE

CHARACTERISTICS OF THE LICENSING PROCESS

1) APPROVAL IN STAGES

2) BURDEN OF PROOF ON THE APPLICANT

3) INSPECTION AT ALL STAGES

4) JOINT REVIEW BY REGULATORY AGENCIES

FIGURE 2

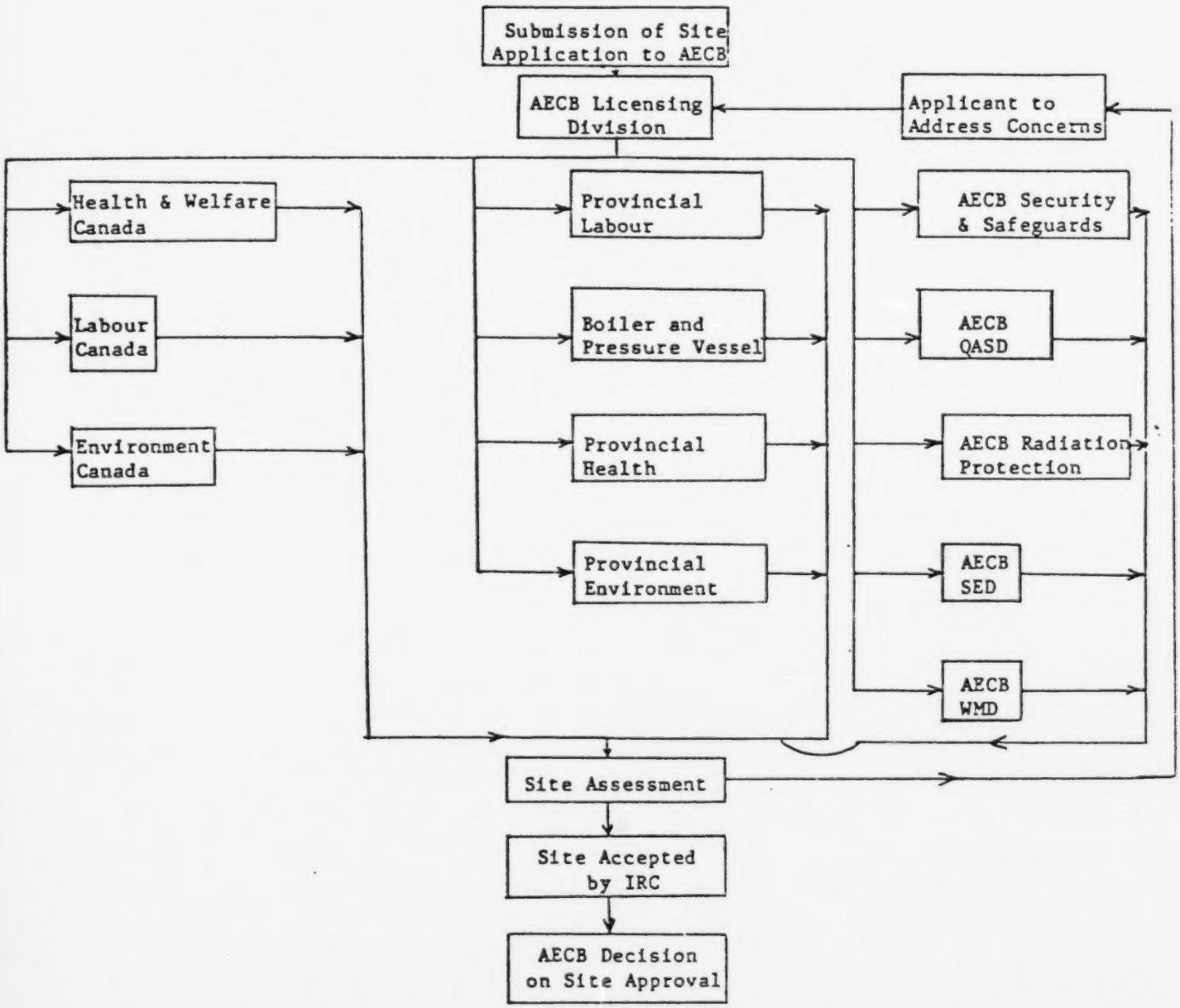


FIGURE 3

Joint Regulatory Process Chart

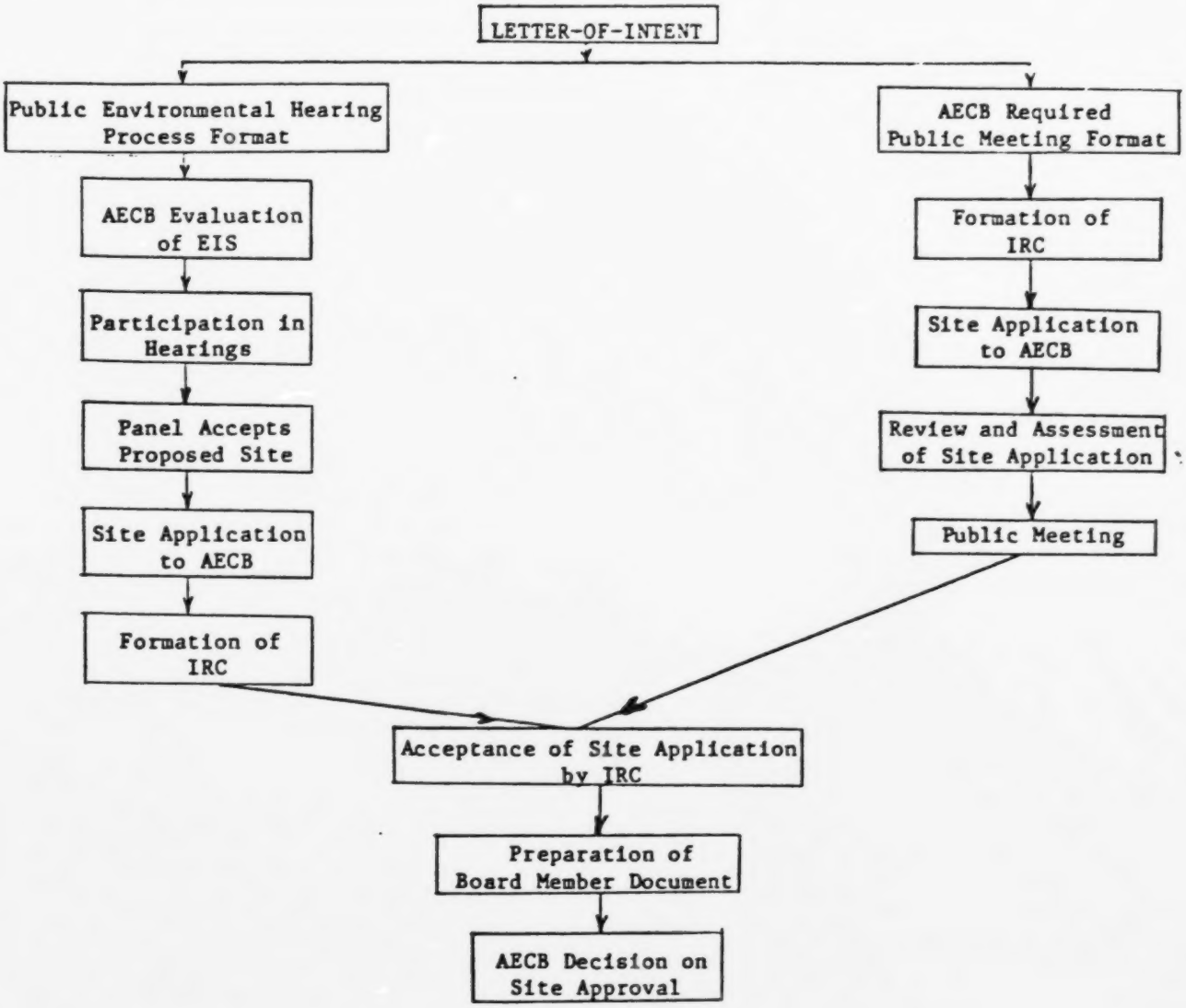
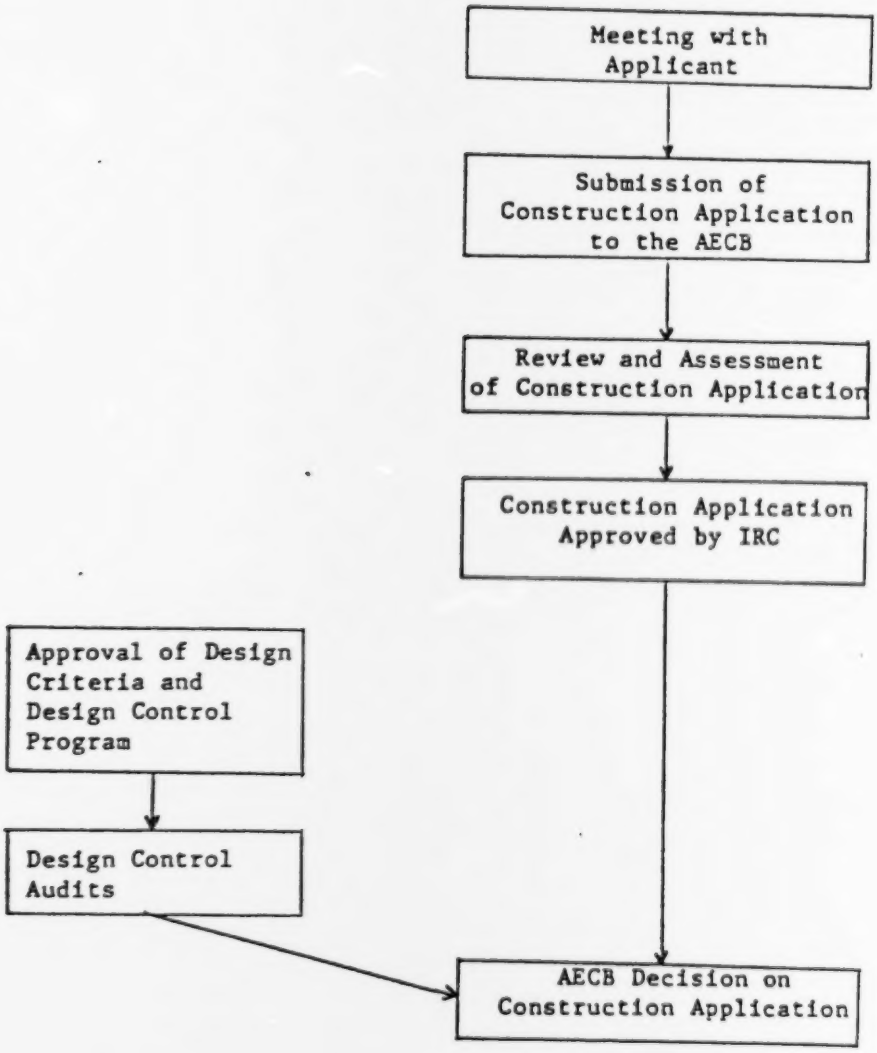

LETTER-OF-INTENT
Public Environmental Hearing Process Format
AECB Evaluation of EIS
Participation in Hearings
Panel Accepts Proposed Site
Site Application to AECB
Formation of IRC
AECB Required Public Meeting Format
Formation of IRC
Site Application to AECB
Review and Assessment of Site Application
Public Meeting
Acceptance of Site Application by IRC
Preparation of Board Member Document
AECB Decision on Site Approval

FIGURE 4

Site Approval
Licensing Process
Chart


Meeting with Applicant
Submission of Construction Application to the AECB
Review and Assessment of Construction Application
Construction Application Approved by IRC
Approval of Design Criteria and Design Control Program
Design Control Audits
AECB Decision on Construction Application

Construction Approval
Licensing Process

FIGURE 5